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Mt. Frank Roy/Mt. Monteith Stone's Sheep Transplant Evaluation

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1.0 INTRODUCTION

The Williston Reservoir watershed supports approximately 10% of the world's 11,000 Stone's sheep *(Ovis dalli stonei),* including about 160 animals in the reservoir's Peace Arm drainage (Davidson and Dawson 1990). The majority of sheep in this drainage are found on the north side of the Peace Arm between the Nabesche River and Butler Ridge (Davidson and Dawson 1990). Only a few small bands of sheep exist south of the Peace Arm, and those in the eastern portion are the result of a transplant. During a 1991 inventory of the area south of the Peace Arm, only 11 Stone's sheep were sighted: 7 in the west on Mt. Selwyn, and 4 (transplanted to the area one year earlier) on Mt. Monteith in the east (Backmeyer 1991*a*). Eight sheep were observed on Mt. Selwyn during a winter inventory in 1996 (Hengeveld and Wood 1998).

Wildlife translocations are one of a variety of methods the Peace/Williston Fish and Wildlife Compensation Program (PWFWCP) has adopted to enhance ungulate populations within the Williston Reservoir watershed. Biophysical capability studies indicated that the Mt. Frank Roy/Mt. Monteith area in the upper Carbon Creek drainage south of the Peace Arm could support approximately 100 Stone's sheep (Davidson 1989). In 1990 and 1991, the PWFWCP undertook the first transplant of Stone's sheep in North America, moving 22 sheep from the north side of the Peace Arm to Mt. Frank Roy and Mt. Monteith in the Upper Moberly River drainage. The objectives of the transplant were to establish a viable population of sheep south of the Peace Arm, and to increase the range of Stone's sheep in the watershed (Backmeyer 1991*b*; PWFWCP, unpublished data). A third transplant of 6 sheep to Mt. Monteith was conducted in 1993 (Wood 1995a).

Ten of the 28 transplanted sheep were collared with radio-transmitters to monitor their seasonal habitat use and movements; all but 2 of the remaining 18 sheep were eartagged (Backmeyer and Wood, in prep *a).* By 1996, 9 of the 28 sheep had died, while 3 were confirmed to be still alive. The fates of the remaining 16 sheep were unknown. A series of total count inventories have been conducted to monitor the success of the Stone's sheep translocations (Wood 1992, 1993, 1995*b*,c). Fourteen sheep were located in June 1992 and 15 in December 1992, while only 7 sheep were located during winter surveys conducted in 1994 and 1995.

A fourth winter inventory of ungulates using alpine and subalpine winter habitats in the Upper Moberly River and McAllister Creek drainages south of the Peace Arm was conducted on 27 March 1996. The primary objective of the survey was to determine the population size, demographics (age/sex composition), and distribution of Stone's sheep residing in the area.

This reports documents these results. A secondary objective of the inventory was to determine the same parameters for woodland caribou, the results of which are presented in Wood and Hengeveld (1998).

2.0 SURVEY AREA AND WEATHER CONDITIONS

The survey area is located on the south side of the Williston Reservoir's Peace Arm in north-central British Columbia (Figure 1). The survey area lies in the Peace Foothills and Hart Foothills ecosections of B.C.'s Central Canadian Rocky Mountains ecoregion (Demarchi 1995), on the lee side of the Hart Mountain Ranges. Bedrock types in the Hart Ranges consist primarily of erosion-resistant limestones and quartzites, resulting in moderate, rolling terrain (DeLong et al 1994). Chinook winds (warm coastal winds flowing through the mountain passes into the valleys east of the Rocky Mountains) are common (Backmeyer and Wood, in prep *a)*, resulting in reduced snow accumulations and slightly milder winter conditions than in the mountains to the west. Biogeoclimatic zones in the upper elevations of these mountains include the Engelmann Spruce-Subalpine Fir (ESSFwc3) zone between 1,300 and 1,550 m elevation, and the Alpine Tundra (AT) zone above 1,550 m (Delong et al. 1994). The survey area included alpine and subalpine habitats on six mountains in the Moberly River and Carbon Creek drainages: Boulder Ridge, Mt. Bickford, Mt. Monteith, Mt. Frank Roy, Beattie Peaks, and Mt. McAllister (Figure 2).

Weather conditions on 27 March 1996 were clear and sunny, with a light northerly wind; temperature was -12°C at 1,750 m. Boulder Ridge was over 90% snow covered, while Mt. McAllister, Mt. Frank Roy, and Beattie Peaks had many windswept areas. The south and east-facing cliffs at Mt. Monteith and Mt. McAllister were about 90% snow-free.

3.0 METHODS

The survey was conducted between 1000 and 1730 hrs on 27 March 1996, with a Bell 206 helicopter chartered from Northern Mountain Helicopters (Prince George, BC). The survey took 8.4 hours of flying time, including ferry time to and from the survey area and two refueling stops at Clearwater Camp. The inventory followed standard inventory methodology (RIC 1997), and involved a thorough search of all alpine and subalpine areas. Where the

Figure 1. Survey area within the Williston Reservoir watershed, north-central BC.

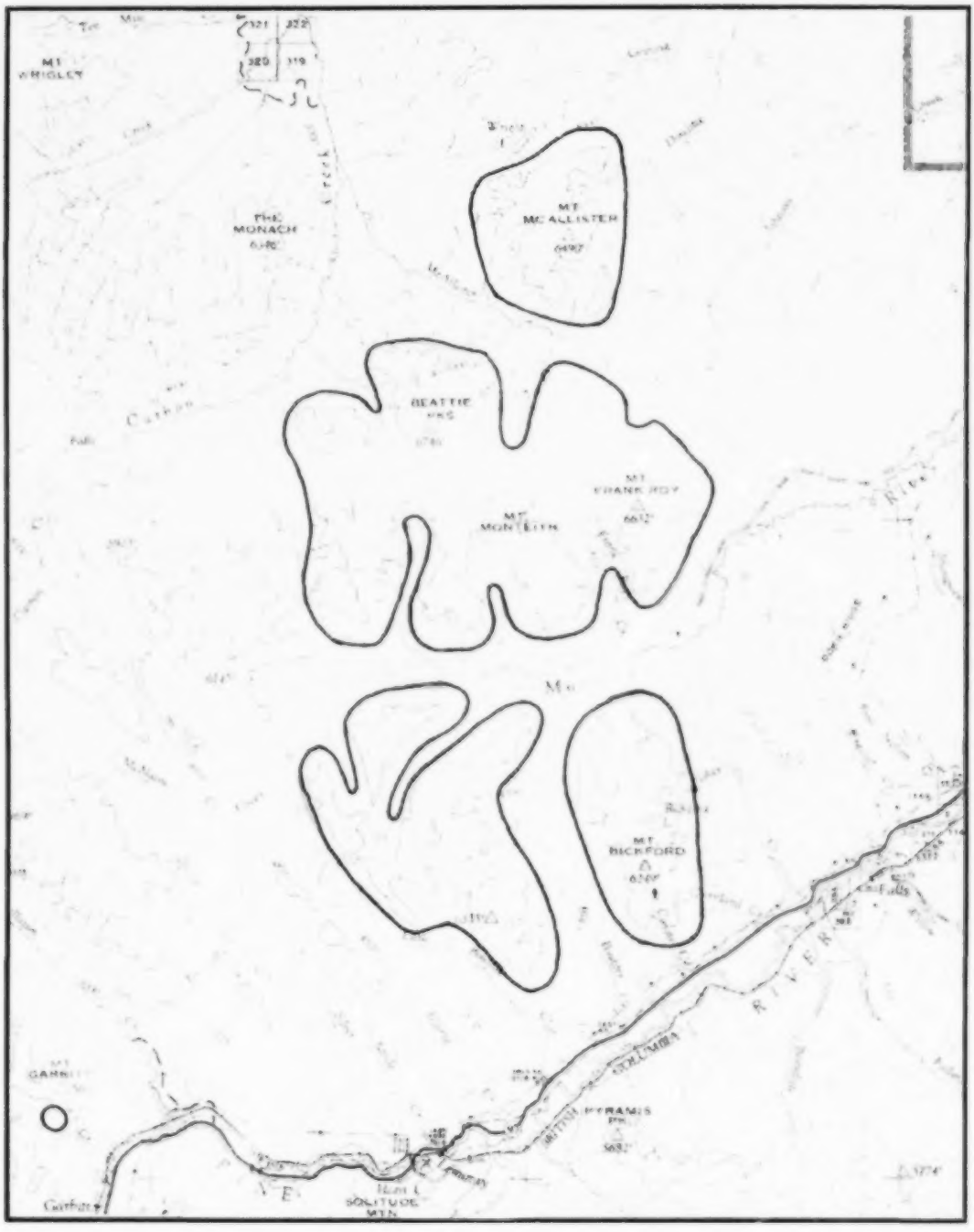

Figure 2. Specific mountains surveyed in the Mt. Frank Roy/Mt. Monteith area south of the Peace Arm on 27 March 1996. (Scale: 1:250,000)

distance from the upper ESSF to the height of land was such that animals at either extreme could be missed, two or three parallel transects at different contour intervals were warranted.

The navigator (Mari Wood, Senior Wildlife Biologist, PWFWCP), searched for, counted and classified animals, and recorded the flightline and animal locations on 1:250,000 topographic maps. The two rear seat observers (Fraser Corbould, Wildlife Biologist, PWFWCP, and John Metcalfe, Regional Fish and Wildlife Manager, BC Environment Omineca Sub-Region) also searched for and classified animals. F. Corbould recorded all observations on survey forms, and J. Metcalfe recorded latitude/longitude co-ordinates for each group of animals located using the helicopter's on-board Global Positioning System (GPS) unit. Recorded co-ordinates were later converted into UTM co-ordinates through ArcInfo Geographic Information System (GIS). Stone's sheep were classified based on horn development as adult ewes, adult rams (class II, III, or IV), yearlings, or lambs (Geist 1971).

To illustrate general winter weather trends, snow depths for the winter periods (Jan-Apr) of 1990 to 1996 were obtained from two snow monitoring stations in the the Rocky Mountains closest to the study area: Pine Pass, 40 km southwest of the transplant site, and Lady Laurier, 70 km north of the Peace Arm (BC Environment, 1990 - 1996).

4.0 RESULTS

We located 6 Stone's sheep in the survey area: 1 in the alpine on Mt. Frank Roy, and 5 on the south-facing cliffs of Mt. Monteith (Table 1, Figure 3). A few tracks, either Stone's sheep or mountain goats, were also observed on Mt. McAllister. The lone Class III (3/4 curl) ram sighted on Mt. Frank Roy had been transplanted to Mt. Monteith in 1991 at five years of age, as confirmed by the red ear-tag in its right ear. A ewe and her lamb transplanted to Mt. Monteith in 1993 were also sighted on the survey; the ewe had been radio-collared (#030) and the 9 month old lamb had been marked with a green ear-tag prior to translocation. Ewe #030 was observed with a new lamb (group #2), while the ear-tagged lamb, now almost four years old, was sighted together with another ewe and a yearling (group #3). All sheep observed appeared to be in good physical condition.

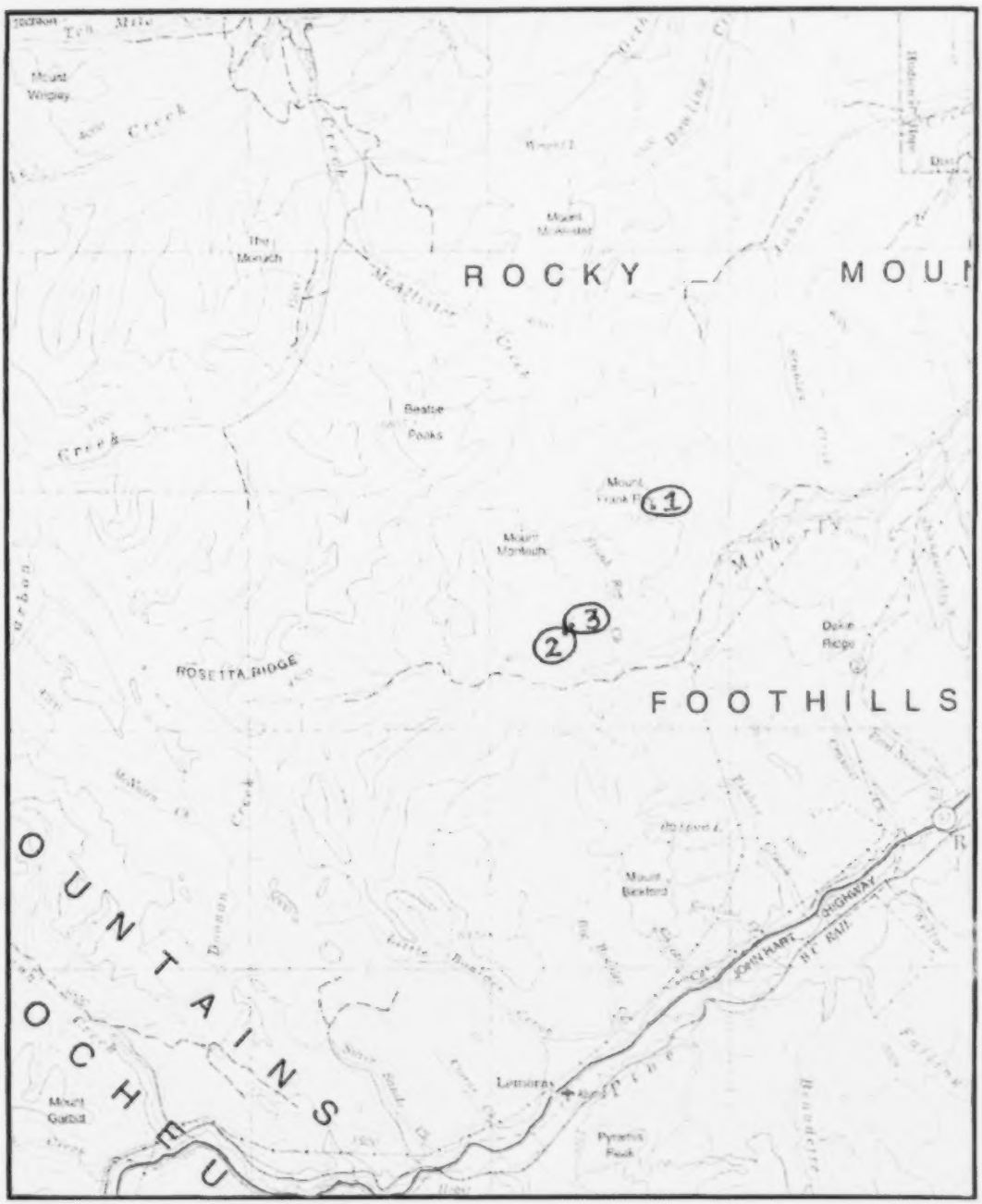

Figure 3. Locations of Stone's sheep groups observed on Mt. Frank Roy and Mt. Monteith on 27 March 1996. (Scale: 1:250,000)

Table 1. Locations and classifications of Stone's sheep groups observed on 27 March 1996 in the Mt. Frank Roy/Mt. Monteith area south of the Peace Arm.

Grp #	Area	UTM Coord's E	UTM Coord's N	Elev (m)	Habitat	Class III Ram	Ewe	Yrlg	Lamb	Total
1	Fr. Roy	537028	6179155	1,780	alpine	1				1
2	Monteith	533407	6173932	1,460	rocky cliff		1		1	2
3	Monteith	533510	6174118	1,580	rocky cliff		2	1		3

5.0 DISCUSSION

Occasional sightings of Stone's sheep in the Mt. Frank Roy/Mt. Monteith area have been reported in recent years. TERA Environmental Consultants sighted 6 Stone's sheep during their January 1996 ungulate survey in the Upper Pine and Carbon Creek watersheds (TERA, 1996). The sheep were observed on the north end of Mt. Bickford, approximately 4 km south of the cliffs on Mt. Monteith where we observed 5 sheep in March. The 6 sheep were classified as a large ram, a small ram, 2 ewes, and 2 unclassified sheep (R. Glaholt, TERA Environmental, Vancouver, BC, personal communication). Other than the smaller ram, it is unknown whether these are different animals from those we observed 2 months later. An incidental sighting of a Class IV ram on the southfacing cliffs on Mt. Monteith was recorded on May 7, 1997 (M. Wood, personal observation). This animal was either native to the area or an offspring from one of the transplanted sheep, since only 5 rams had been transplanted to the area in 1990 and 1991, 1 of which was sighted on this survey, while the other 4 have died (Backmeyer and Wood, in prep *a)*. A. DeVries (Canfor, Chetwynd, BC, personal communication) also received a report of a full-curl ram east of Carbon Inlet in November 1997; no ear-tags were reported to be observed.

Only a small isolated population of Stone's sheep appears to be established in the Mt. Frank Roy/Mt. Monteith area as a result of the 3 transplants between 1990 and 1993. For transplanted populations, approximately 15 to 20 individuals are required to actively participate in breeding in order to transmit the genetic diversity of the source population (Pettus 1982). Although many bighorn sheep *(Ovis canadensis)* transplants have been successful, numerous others have fallen short of their objectives, resulting in relatively low transplant success rates (Bailey 1988, Risenhoover et al 1988, Smith et al 1988, Cook et al 1990). The results of the second transplant

of Stone's sheep in North America, conducted in the Atlin area of northwestern B.C., have been somewhat more encouraging however. Surveys conducted in the winter of 1997/98 recorded 45-50 sheep in the area, from the original 24 transplanted in 1994 and 1995 (BC Environment Skeena Region, unpublished data).

We present three possible hypotheses for why only a small population of transplanted Stone's sheep has been established in the Mt. Frank Roy/Mt. Monteith area:

1. *Severe winter snow conditions.* Radio-collared Stone's sheep transplanted to the area in 1990 and 1991 experienced high mortality in the first few post-transplant years: 6 of 7 collared sheep had died by the summer of 1993. If the high early mortality experienced by the collared animals is indicative of the fate of the non-collared animals, few sheep from the original two transplants are expected to have survived and reproduced. Sheep transplanted in 1993 appeared to have met with marginally higher success; only 1 of the 3 collared sheep was confirmed to have died by 1996. In addition, an ear-tagged lamb transplanted in 1993 also survived to 1996. The results of a study monitoring transplanted sheep in Montana indicated that the success of transplants depends primarily on weather conditions in the year of the transplant, and the years immediately following (Roy and Irby 1994). The winters of 1990, 1991, and 1992 were all well above normal with record high snowfalls recorded at both the Pine Pass and Lady Laurier monitoring stations in 1992 (BC Environment, 1990 - 1996). Near record snowfalls were recorded in some winter months in 1990 and 1991. Snow depths recorded during the winter of 1993 were far below average, and coincided with the third transplant of animals. The Lady Laurier station recorded another low snowfall year in 1994 (measurements were not recorded at the Pine Pass station), however, snow depths were reported to appear deeper than normal on Mt. Monteith in March 1994 (R. Woods, BC Environment, Fort St. John, BC, personal communication), and may have resulted from a lack of chinook wind events. An additional 2 radio-collared ewes died that winter (one from the 1991 transplant, and one from 1993). Winter 1995 snow depths were slightly below normal, while 1996 snowfall was above average.

2. *Dispersal from transplant site.* In the first few years following the initial 1990 and 1991 transplants there were several confirmed and unconfirmed sightings of Stone's sheep reported 15-20 km south of the release site, along Highway 97 between Lemoray and Willow Flats in the Pine River valley. Nine sheep were more recently sighted in the Falling Creek area south of the highway in 1997 (A. DeVries, Canfor, Chetwynd, BC, personal communication). The Pine River valley lies in the Sub-Boreal Spruce wet cool

biogeoclimatic zone (SBSwk2) west of Fisher Creek, and in the Boreal White and Black Spruce moist warm (BWBSmwl) zone to the east. Lower elevation cliffs are common along the north side of the highway, many surrounded by trembling aspen *(Populus tremuloides)* dominated slopes and old burns. It is possible that some of the transplanted sheep moved from the original release sites to establish themselves in these areas, or on ranges to the north and west. These outlying areas have not been surveyed, therefore presence of sheep in these areas are unknown.

3. *Contact with domestic sheep.* Between 1992 and 1994 the Conservation Officer Service (COS) in Chetwynd received several calls from ranchers along Highway 97 in the Pine River valley concerning Stone's sheep interacting with domestic sheep, including reports of breeding attempts between the wild rams and domestic ewes. One particularly persistent wild ram at a ranch 10 km west of Chetwynd (45 km east of Mt. Monteith) was captured and tranquilized for removal. It was marked with a yellow ear-tag and released at Callazon Creek, 25 km southwest of Mt. Monteith, in May 1994 (BC Environment COS, Chetwynd, BC, unpublished data). Studies have shown that bighorn sheep experience significant mortality due to respiratory disease (pneumonia) following contact with domestic sheep (Onderka and Wishart 1988, Foreyt 1989, 1990, Foreyt et al. 1994, Martin et al. 1996). *Pasteurella haemolytica* is a common organism carried in the pharyngeal area of healthy domestic sheep, however, some strains of the organism (particularly serotype A2) cause respiratory disease and are lethal in bighorn sheep (Foreyt 1994). To date, bacterial pnemonia has not been reported in thinhorn sheep *(Ovis dalli* sp.) or mountain goats *(Oreamnos americanus),* however, an experiment by Silflow et al. (1994) demonstrated that Dall sheep (O. *dalli dalli),* and to a lesser extent, mountain goats, are susceptible to mortality losses due to *P. haemolytica* A2. More recent neutrophil sensitivity testing conducted on Stone's sheep blood, has confirmed that Stone's sheep are equally as sensitive to *P. haemolytica* as other wild sheep (W.J. Foreyt, Washington State University, personal communication). After interacting with the domestic sheep, the ram transplanted back into Stone's sheep range may have transmitted the disease to other members of the herd, with potentially fatal results.

Though it is unknown which, if any, of these factors is the principle cause for the apparently low number of sheep present in the Mt. Frank Roy/Mt. Monteith area, a combination of these factors is most likely.

6.0 RECOMMENDATIONS

To aid in determining if the 1990-1993 transplants were successful at establishing a Stone's sheep population south of the Peace Arm, a thorough effort should be made to determine the numbers of sheep and the extent to which they are distributed south of the Arm. To date, surveys have focused on the mountains in the immediate vicinity of Mt. Monteith. We recommend that a larger area be searched, including the lower elevation cliffs along the north side of Highway 97, some mountain ranges south of the highway (between Le Moray and Falling Creeks), and some additional ranges to the north and west of the traditionally surveyed area. The majority of these ranges should be surveyed by helicopter, however, some areas of suitable sheep habitat along Highway 97 could be surveyed more intensively from the ground with the use of spotting scopes.

7.0 LITERATURE CITED

Backmeyer, R. 1991a. Wildlife distribution and habitat use south of the Peace Reach of Williston Reservoir, February 1991. Peace/Williston Fish and Wildlife Compensation Program Report No. 7. 19pp.

_____. 1991b. Mt. Frank Roy Stone's sheep transplant, March 1991. Status report. Unpublished. Peace/Williston Fish and Wildlife Compensation Program, Prince George, BC. 8pp.

_____, and M.D. Wood. In prep *a.* Seasonal habitat use and movements of transplanted Stone's sheep in the Mt. Frank Roy/Mt. Monteith area, north-eastern BC. Peace/Williston Fish and Wildlife Compensation Program, Prince George, BC.

_____, and_____. In prep *b.* Seasonal habitat use and movements of woodland caribou in the Graham River drainage, north-eastern BC. Peace/Williston Fish and Wildlife Compensation Program, Prince George, BC.

Bailey, J.A. 1988. Transplants - not the only answer. Rocky Mountain Bighorn Society Newsletter. 44: 4-5.

BC Environment. BC Environment Snow Survey Bulletins January - April 1990-1996. BC Environment Hydrology Branch, Victoria, BC.

Cook, J.G., E.B. Arnett, L.L. Irwin, and F.G. Lindzey. 1990. Population dynamics of two transplanted bighorn sheep herds in southcentral Wyoming. Bienn. Symp. North. Wild Sheep and Goat Counc. 7:19-30.

Davidson, P.W. 1989. Mt. Frank Roy Stone's sheep transplant working plan. Internal Report, prepared for Peace/Williston Fish and Wildlife Compensation Program, Prince George, BC. 3pp plus appendices.

_____, and R. Dawson. 1990. Williston Wildlife Compensation Program Management Plan, 1990. Peace/Williston Fish and Wildlife Compensation Program Report No. 5. 44pp.

DeLong, C., D. Tanner, and M.J. Jull. 1994. A field guide for site identification and interpretation for the Northern Rockies portion of the Prince George Forest Region. Ministry of Forests Land Management Handbook Number 29. Ministry of Forests, Prince George, BC. 141 pp.

Demarchi, D.A. 1995. Ecoregions of British Columbia. Fourth Edition. 1:2,000,000 Mapsheet. Ministry of Environment, Lands, and Parks.

Foreyt, W.J. 1989. Fatal *Pasteurella haemolytica* pneumonia in bighorn sheep following direct contact with normal domestic sheep. Am. J. Vet. Res. 50: 341-344.

_____. 1990. Pneumonia in bighorn sheep: *Effects of Pasteurella haemolytica from* domestic sheep and effects of survival on long-term reproduction. Bienn. Symp. North. Wild Sheep and Goat Counc. 7: 92-101.

_____. 1994. Effects of controlled contact exposure between healthy bighorn sheep and llamas, domestic goats, mountain goats, cattle, domestic sheep, or mouflon sheep. Bienn. Symp. North. Wild Sheep and Goat Counc. 9: 7-14.

_____, K. P. Snipes, and R. W. Kasten. 1994. Fatal pneumonia following inoculation of healthy bighorn sheep with *Pasteurella haemolytica* from healthy domestic sheep. J. Wildl. Dis. 30: 137-145.

Geist, V. 1971. Mountain sheep: A study in behaviour and evolution. Univ. Chicago Press, Chicago. 383 pp.

Hengeveld, P.E. and M.D. Wood. 1998. Misinchinka Ranges winter ungulate inventory, March 1996. Peace/Williston Fish and Wildlife Compensation Program Report No. 175. 19pp plus appendices.

Martin, K.D., T. Schommer, and V.L. Coggins. 1996. Literature review regarding compatibility between bighorn and domestic sheep. Bienn. Symp. North. Wild Sheep and Goat Counc. 10: 72-77.

Onderka, D.K. and W.D. Wishart. 1988. Experimental contact transmission *of Pasteurella haemolytica* from clinically normal domestic sheep causing pneumonia in Rocky Mountain bighorn sheep. J. Wildl. Dis. 24: 663-667.

Pettus, D. 1982. Potential genetic effects of small population size in wildlife. Bienn. Symp. North. Wild Sheep and Goat Counc. 3: 25-33.

RIC (Resources Inventory Committee). 1997. Standardized inventory methodologies for components of British Columbia's biodiversity: Aerial based inventory techniques for selected ungulates. Version 1.1. Resources Inventory Committee, Ministry of Environment, Lands, and Parks, Victoria, BC.

Risenhoover, K.L., J.A. Bailey, and L.A. Wakelyn. 1988. Assessing the Rocky Mountain sheep management problem. Wildl. Soc. Bull. 16: 346-352.

Roy, J.L., and L.R. Irby. 1994. Augmentation of a bighorn sheep herd in southwest Montana. Wildl. Soc. Bull. 22: 470-478.

Silflow, R.M., W.J. Foreyt, and J.E. Lagerquist. 1994. Evaluation of the cytotoxicity of various isolates of *Pasteurella haemolytica* from bighorn sheep and other ungulate populations. Proc. Bienn. Symp. North. Wild Sheep and Goat Counc. 9: 1-6.

Smith, T.S., J.T. Flinders, and D.W. Olsen. 1988. Status and distribution of Rocky Mountain bighorn sheep in Utha. Proc. Bienn. Symp. North. Wild Sheep and Goat Counc. 6: 5-12.

TERA Environmental Consultants (Alta.) Ltd. 1996. Large mammal surveys of the Upper Pine River/Carbon Creek watersheds, British Columbia. January-April 1996. Prepared for Talisman Energy Inc. and Amoco Canada Petroleum Company Ltd., Calgary, AB. 20pp.

Wood, M.D. 1992. South Peace Arm Stone's sheep inventory, June 1992. Peace/Williston Fish and Wildlife Compensation program Report No. 14. 5pp.

_____. 1993. South Peace Arm Stone's sheep inventory, December 1992. Peace/Williston Fish and Wildlife Compensation Program Report No. 23. 3pp plus appendices.

_____. 1995a. Mount Frank Roy Stone's sheep transplant, March 1993. Peace/Williston Fish and Wildlife Compensation Program Report No. 47. 2pp plus appendices.

_____. 1995b. South Peace Arm Stone's sheep and woodland caribou inventory, March 1994. Peace/Williston Fish and Wildlife Compensation Program Report No. 48. 3pp.

_____. 1995c. South Peace Arm Stone's sheep and woodland caribou inventory, March 1995. Peace/Williston Fish and Wildlife Compensation Program Report No. 49. 9pp.

_____, and P. Hengeveld. 1998. Woodland caribou inventory in the Upper Moberly River and McAllister Creek drainages, March 1996. Peace/Williston Fish and Wildlife Compensation Program Report No. 183. 13 pp plus appendices.